

REMARKS

The Official Action mailed December 12, 2002, has been received and its contents carefully noted. Filed concurrently herewith is a *Request for One Month Extension of Time*, which extends the shortened statutory period for response to April 14, 2003. Accordingly, the Applicant respectfully submits that this response is being timely filed.

The Applicant notes with appreciation the consideration of the Information Disclosure Statement filed on December 12, 2002. The Applicant awaits consideration of the Information Disclosure Statement filed March 19, 2002.

Claims 1-27 were pending in the present application. Independent claims 1-3 and 23 have been amended to better recite the features of the present invention, and new claims 28-36 have been added to recite additional protection to which the Applicant is entitled. Claims 1-36 are now pending in the present application, of which claims 1-3, 23 and 28-30 are independent. For the reasons set forth in detail below, all claims are believed to be in condition for allowance.

The present invention solves a problem whereby a semiconductor film is etched when a doping process such as channel doping is carried out. The Applicant finds that the problem is caused by hydrogen ions. The Applicant has found a solution to the problem either by forming a chemical oxide film (claims 1 and 28), by terminating dangling bonds with oxygen (claims 2 and 29) or by terminating dangling bonds with an element to be bonded with a bonding energy higher than that of Si-H bonds as a pretreatment (claims 3 and 30). Further, each of the above-referenced method steps is combined with a channel doping process according to an experiment described in the specification at p. 4, line 4 through p. 6, line 20 and Fig. 1.

The Official Action rejects claims 1-27 as anticipated by U.S. Patent No. 5,966,596 to Ohtani et al. The Applicant respectfully submits that an anticipation rejection cannot be maintained against the independent claims of the present invention, as amended. Ohtani does not teach all the elements of the independent claims, either explicitly or inherently.

Example 1 of Ohtani appears to disclose a method comprising the steps of forming a thin oxide film on an amorphous silicon film 103 (the Official Action asserts

that this step corresponds with the pretreatment step of the present invention), forming a silicon oxide film 104 over the amorphous silicon film 103 as shown in Fig. 1A, patterning the crystalline silicon film 106 to form an active layer 107 as shown in Fig. 1D, forming a silicon oxide film 109 which is a gate insulating film 110 including the silicon oxide film 104, forming a gate electrode 111 as shown in Fig. 2A and introducing dopant ions to form a source region 113, a drain region 114, and a channel region 115 by a self-aligned technology as shown in Fig. 2C.

Independent claims 1-3, as amended, recite channel doping comprising the steps of doping a semiconductor film comprising silicon with impurity ions after forming a chemical oxide film, and forming at least one channel region comprising a portion of the doped semiconductor film. As noted above, Ohtani uses a self-aligned technology to form the channel region. Therefore, it is respectfully submitted that Ohtani does not disclose a channel region comprising a portion of a doped semiconductor film.

Further, independent claim 23 has been amended to recite the order of the steps of the method. Specifically, claim 23 recites doping after the pretreatment, patterning after the doping, forming a gate insulating film after patterning and forming a gate electrode after forming the gate insulating film. Ohtani does not teach or suggest the above-recited order of the steps of the method of the present invention.

Since Ohtani does not teach all the elements of the independent claims, either explicitly or inherently, an anticipation rejection cannot be maintained. Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b) is in order and respectfully requested.

In addition, new claims 28-36 have been added. Independent claims 28-30 are similar to claims 1-3, respectively. For the reasons stated above, the Applicant respectfully submits that new claims 28-36 are in condition for allowance.

Should the Examiner believe that anything further would be desirable to place this application in better condition for allowance, the Examiner is invited to contact Applicant's undersigned attorney at the telephone number listed below.

Respectfully submitted,


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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend claims as follows:

1. (Amended) A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor film comprising silicon over an insulating substrate;

forming a chemical oxide film on a surface of the semiconductor film comprising silicon as a pretreatment; [and]

doping the semiconductor film comprising silicon with impurity ions after forming the chemical oxide film[.]; and

forming at least one channel region comprising a portion of the doped semiconductor film.

2. (Amended) A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor film comprising silicon over an insulating substrate;

terminating dangling bonds on a surface of the semiconductor film comprising silicon with oxygen as a pretreatment; [and]

doping the semiconductor film comprising silicon with impurity ions after terminating dangling bonds on a surface of the semiconductor film; and [.]

forming at least one channel region comprising a portion of the doped semiconductor film.

3. (Amended) A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor film comprising silicon over an insulating substrate;

terminating dangling bonds on a surface of the semiconductor film comprising silicon with an element to be bonded with bonding energy higher than that of Si-H bonds as a pretreatment; [and]

doping the semiconductor film comprising silicon with impurity ions after terminating dangling bonds on a surface of the semiconductor film; and [.]

forming at least one channel region comprising a portion of the doped semiconductor film.

23. (Amended) A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor film comprising silicon over an insulating substrate;

forming a chemical oxide film on a surface of the semiconductor film comprising silicon as a pretreatment;

doping the semiconductor film comprising silicon with impurity ions after forming the channel oxide film;

patterned the semiconductor film to form at least one active layer after doping;

forming a gate insulating film over the active layer after patterning the semiconductor film; and

forming a gate electrode over the semiconductor film with the gate insulating film interposed therebetween,

wherein the chemical oxide film is formed by a treatment with at least one material selected from the group of: ozone water and a hydrogen peroxide solution.